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TEAM LOCUS-OF-CONTROL COMPOSITION, LEADERSHIP STRUCTURE, INFORMATION ACQUISITION, AND FINANCIAL PERFORMANCE: A BUSINESS SIMULATION STUDY

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We argue that team information acquisition mediates the effect of the relationship of team locus-of-control composition and leadership structure on team financial performance in a decision-making context. Hypotheses were tested on 44 teams participating in an elaborate and lengthy international management simulation. As predicted, teams with high average internal locus-of-control scores performed better without leaders and with low locus-of-control heterogeneity. The opposite was found for teams with high average external locus-of-control scores. Contrary to expectations, teams with high locus-of-control heterogeneity did not benefit more from having leaders than teams with low heterogeneity. Information acquisition mediated relationships between locus-of-control composition and performance.

Pfeffer's (1983) and Hambrick and Mason's (1984) independent pleas to study organizational and top management team demography have triggered a substantial body of empirical research into the effects of team composition variables on team and organizational outcomes. Generally, early research studied simple "main effects" of the means and the spread of variables measuring demographic characteristics on outcome variables such as turnover, innovation, diversification, and performance. From these efforts, researchers have learned that team composition does indeed make a difference. However, as is now generally acknowledged, the relationship between team composition and outcomes is much more complex than was originally thought (Lawrence, 1997; Priem, Lyon, & Dess, 1999; Williams & O'Reilly, 1998). Recent empirical investigations therefore have developed more complex theoretical and empirical team composition models in a number of ways. For instance, scholars now distinguish between different kinds of team diversity, such as deep-level versus overt demographic diversity (Harrison, Price, & Bell, 1998; Jehn & Mannix, 2001; Jehn, Northcraft, & Neale, 1999; Pelled, 1996; Pelled, Eisenhardt, & Xin, 1999).

Furthermore, researchers are now analyzing mediating mechanisms that underlie observed relationships, and they have begun to include moderator variables such as time (Harrison et al., 1998), task complexity and interdependence (Jehn et al., 1999), task routineness and group longevity (Pelled et al., 1999), and interpersonal congruence (Polzer, Milton, & Swann , 2002). In the present study we follow the lead of these researchers by developing hypotheses that go beyond simple main effects, by taking into account basic contingency and mediating variables. We take leadership structure as a moderator, responding to the plea of several researchers to incorporate team structure variables, such as power distribution and role interdependencies, in team composition research (Finkelstein, 1992; Finkelstein & Hambrick, 1996; Mintzberg, 1979). We focus on a specific deep-level characteristic of team members, the locus-of-control personality trait (Rotter, 1966), and test a mediating model relating team locus-of-control composition to team financial performance through information acquisition behavior.

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Apart from focusing on complex and subtle interaction effects, our study makes two additional contributions to the team composition literature. First, our study is one of the first to focus on personality as a composition variable. In their comprehensive review of top management team research, Priem and colleagues (1999) saw the tendency to sacrifice construct validity for reliable measurement as a major flaw of previous studies. That is, a few notable exceptions aside (e.g., Barrick, Stewart, Neubert, & Mount, 1998), the emphasis has almost exclusively been on assessing the *demographic* characteristics of team members, not so much for substantive reasons but rather because of their availability and measurability. This is the case both in top management team research (Hambrick, Geletkanycz, & Frederickson, 1993) and in the broader social psychological field of intragroup functioning and effectiveness (Barrick et al., 1998). A focus on more fundamental behavioral tendencies rooted in personality is warranted because these are more directly linked to behavior and provide a more valid measurement of values and attitudes than do demographic variables (Hambrick & Mason, 1984).

Second, the focus on more "substantive" dimensions of individual differences such as locus of control offers the opportunity to study other important *dependent* variables outside the current domain of mainstream team composition research. As there is ample experimental and field evidence that individuals with an internal locus of control gather more information in the course of decision making and are better at information processing than those with an external locus of control (Lefcourt, 1982), we chose to explain the *information acquisition behavior* of different teams as a function of their locus-of-control composition. Another reason to focus on information acquisition behavior is that in-depth field research on top management teams suggests that information plays a central role in decision-making effectiveness. This is because such teams are bombarded with information (Hambrick, 1995), making information-processing capacity of vital importance. Notwithstanding the problems of information overload, an analysis by Eisenhardt, Kahwajy, and Bourgeois (1997) of top management teams in technology-based companies suggests that "more information is better," because building decisions on facts focuses team member attention on issues instead of personalities. Because differences in the capacity to gather and handle information are potentially important determinants of decision-making teams' effectiveness, we analyze whether information acquisition behavior mediates the relationship between team locus-of-control composition and team financial performance.

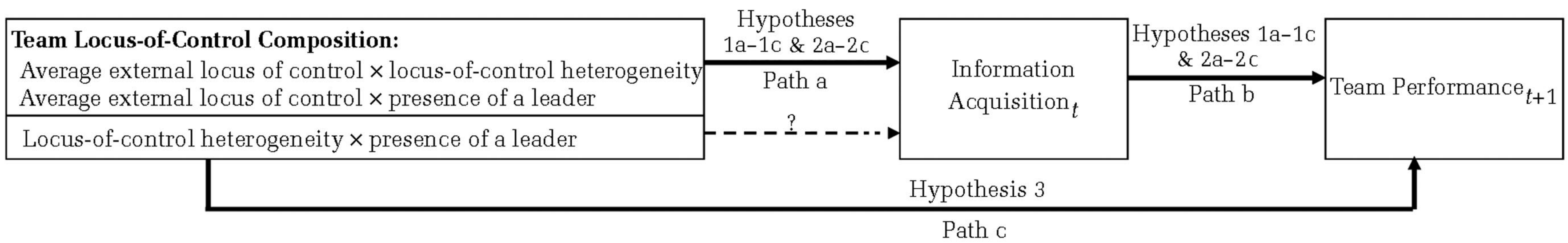
THEORETICAL BACKGROUND AND HYPOTHESES

Locus of control is an important and well-documented personality trait that refers to individual differences in a generalized belief in internal versus external control of reinforcement (in the context of a stimulus and response [Rotter, 1966]). People with an internal locus of control ("internals") see themselves as active agents. They feel that they are masters of their fates, and they trust in their capacity to influence the environment. Conversely, those with an external locus of control ("externals") see themselves as relatively passive agents, believing that the events in their lives are due to uncontrollable forces. We chose to study this particular trait because it indicates fundamental differences between individuals (Boone & De Brabander, 1993). Furthermore, control perceptions appear to be very salient in explaining effective management. Specifically, research into the relationship between CEO locus of control and organizational performance consistently shows that firms led by CEOs who are internals perform better than firms headed by those who are externals, both in the short and the long run (Boone, De Brabander & Hellemans, 2000; Boone, De Brabander, & Van Witteloostuijn, 1996; Miller & Toulouse, 1986). In the present study, we hypothesize on the effects of both the mean and dispersion of this characteristic in teams on information acquisition behavior, which we consider to be a mediating variable in explaining team performance differences. On a general level, we hypothesize that (1) the impact of the team locus-of-control *mean* depends on the within-group locus-of-control *diversity*, and (2) the effects of both the team locus-of-control mean and its standard deviation are contingent on the leadership structure of a group. Figure 1 shows the model that is tested here. The derivation of specific hypotheses is described below.

The Impact of Mean Team Internality

Locus of control is strongly associated with individuals' feelings of potency. People with an external locus of control (externals, or external individuals) tend to feel like pawns in a complicated environment governed by forces outside their own control, whereas internals feel they are active masters of their own fates. Experimental and field studies have indeed shown, time and again, that internals are much more likely and more motivated than

FIGURE 1
Mediated Impact of Team Locus-of-Control Composition on Information Acquisition and Team Performance



externals to use all their faculties to understand and influence their surroundings, as doing so heightens the probability of successfully regulating behavior (for a reviews, see Boone et al. [1996] and Lefcourt [1982]). Not surprisingly, research has demonstrated that internals generally perform better than externals not only in experimental tasks, but also in many achievement-related domains, such as career track and education (Andrisani & Nestel, 1976; Lefcourt, 1982; O'Brian, 1984).

Interesting for the purpose of the present study is that locus of control has been related in numerous experiments with cognitive activities like attention and alertness, and information search and assimilation. Specifically, in reviewing the findings on cognitive capacities of internals versus externals, Phares concluded that internals "acquire more information, make more attempts at acquiring it, are better at retaining it, are less satisfied with the amount of information they possess, are better at utilizing information and devising rules to process it and generally pay more attention to relevant cues in the situation" (1976: 78). All this provides support for the validity of the locus-of-control construct as it is indicative of a basic striving of internals to actively engage in seeking relevant cues in their environments to determine and make sense out of their positions and to guide or adapt their behavior accordingly. Personality research, in addition, makes it clear that individuals with an internal locus of control have larger information-processing capacities than their counterparts with an external locus of control (Govindarajan, 1988, 1989), and they therefore will gather more information and utilize it better in decision making.

One can easily extrapolate this finding to the team level of analysis. A team consisting predominantly of internals is more likely to develop a collective team-level sense of potency. Such a team, compared to a team consisting of externals, will believe that the group can effectively influence team processes and outcomes, such as the quality of decisions. The feeling of collective potency will stimulate such internal teams to collect more information in an attempt to increase team effectiveness. The higher information-processing capacity of teams predominantly consisting of internals will reinforce such intent and efforts. Interestingly, Shea and Guzzo found that team potency—a collective belief of a team's members that the team can be effective—is one of the most important group-level factors that determine "real-world, real-time group effectiveness"(1987: 26). Our reasoning suggests that team potency does not only depend on external contingencies (see Guzzo & Shea, 1987), such as the resources and time a team has to perform a task, but also on the locus-of-control personality traits of its individual members.

To summarize, we expect that internal teams, because of their sense of potency and higher information-processing capacity, will gather more information in a decision-making context. Having information is very important for effective decision making in complex, competitive environments as it helps a team to develop a more complete understanding of choices and to create a richer range of options from which to choose (Eisenhardt et al., 1997). As more information is better in such contexts (Eisenhardt et al., 1997: 79), we also expect internal teams to be more effective; in the study reported here, we expected they would achieve higher financial performance in a simulation game. In other words, information acquisition behavior is expected to mediate the relationship between team internality and performance.

A researcher might test this hypothesis by estimating the main effect of a team's *locus-of-control mean*. In doing so, one implicitly assumes that the so-called additive aggregation model is applicable (Chan, 1998), whereby the higher-level construct is just a summation of the lower-level units, regardless of the variance among these units. However, this model is inappropriate here because our team-level hypothesis is based on individual-level personality theory. In such a case, effects of mean composition can only be expected when dispersion is low (Chan, 1998). To put it differently, "If the team is highly fragmented, the team's overall, average characteristics will have little predictive value" (Hambrick, 1995: 125). As a result, a fair test requires homogeneity (i.e., low dispersion) of the personality traits of team members. Taken together, these arguments lead to the following set of mediation hypotheses:

Hypothesis 1a. Mean team internality and team information acquisition have a positive relationship when team locus-of-control dispersion is low.

Hypothesis 1b. Mean team internality and team financial performance have a positive relationship when team locus-of-control dispersion is low.

Hypothesis 1c. Team information acquisition mediates the relationship explicated in Hypothesis 1b.

The Impact of Team Leadership

We expect that the impact of the mean and the dispersion of the locus-of-control scores on team behavior will depend on the team's *leadership structure*. Surprisingly enough, the moderating effect of team structure variables such as power distribution and role interdependencies are rarely studied (Finkelstein & Hambrick, 1996). In the area of top management team studies, for instance, Finkelstein (1992) noted that the failure to take into account power differences between executives might yield potentially misleading research findings. Obviously, the more decisional power is centralized in the hands of one or a few influential team members, the less it makes sense to expect important effects of team composition variables (Hambrick, 1995). Mintzberg (1979) has already argued that it is too simple to assume that the impact of each member on team outcomes is equal. This assumption is, however, implicitly made when main effects of team composition measures are assessed.

In the present study, we focused on a simple leadership moderator: the presence of a team leader. It is clear that the decision-making process will be quite different in teams with leaders and in teams consisting of equals only. For one, decision making in a team with a leader will be more centralized, implying a larger impact of the preferences of the leader as far as the content of decisions is concerned. In addition, in teams with a leader the flow of information between the members of the team will be more structured, and dominated by vertical channels running from the member to the leader and vice versa. Because leaders tend to structure the flow of information in a team, having a leader is likely to increase the "vertical" information-processing capacity of the team (Galbraith, 1973). In decentralized teams, without a leader, information flows are less structured, with horizontal channels connecting every member dyad of the team (Leavitt, 1951; Mackenzie, 1978). As we will explain below, the structuring, integrating, and coordinating role of leaders might affect the quality of decision-making outcomes and team effectiveness, depending on the composition of a team.

The benefits of leaders in teams of externals. We expect that an external team (one with a high mean externality score) will especially benefit from having a leader. Given that externals lack a feeling of potency, teams primarily consisting of such individuals will also be less likely to develop a sense of collective potency, which is paramount for team effectiveness (Shea & Guzzo, 1987). Having a leader can compensate for this lack of group potency. Indeed, according to Shea and Guzzo, prototypical high-performance teams have supervisors that "guide, direct, and, above all, monitor their group in light of task interdependence, outcome interdependence, and *potency*" (1987: 28; emphasis added). This guidance is exactly what externals need, as previous research has shown that these individuals actually prefer to work in a structured environment with clear leadership (Abel-Halim, 1981; Mitchell, Smyser, & Weed, 1975; Runyon, 1973; Spector, 1982). Conversely, internals are better performers and show higher motivation in participation-demanding environments (Brownell, 1981,1982), prefer positions in which they are able to influence their task environment (Karabenick & Addy, 1979), and prefer working in decentralized settings (Spector, 1982). This line of research clearly suggests that the leadership structure should fit a subordinate's locus of control, and that leadership seems to work especially when people need guidance (i.e., lack a feeling of potency). Thus, we expect that having a leader will increase the performance of teams consisting primarily of externals, but not that of teams dominated by internals. We also expect that differences in the extent of team information acquisition will at least partly explain why especially external and not internal teams will benefit (in terms of team effectiveness) from having leaders. Specifically, external teams will gather less information either because they do not collectively believe they can be effective as a team or because they have a lower team capacity to adequately deal with information. Adding a leader, and thus a "vertical information system," to an external team increases its feeling of potency and probably compensates for insufficient information-processing capacity. The increased potency that a leader brings to an external team will add to the salience of information as a way to "act out" potency and improve performance. As a result, the team's information acquisition prior to decision making will rise. Conversely, internal teams do not need such a vertical information-processing system, as their information-processing capacity is inherently high and their collective potency motivates team information acquisition without the stimulating and structuring presence of a leader. Hence, we expect that having a leader in an internal team will not increase its information acquisition behavior. Because of the importance of information with respect to the quality of decisions in complex decision-making contexts, these arguments lead to the following second set of mediation hypotheses:

> *Hypothesis 2a. Leader presence and team information acquisition have a positive relationship when mean team externality is high.*

> *Hypothesis 2b. Leader presence and team financial performance have a positive relationship when mean team externality is high.*

Hypothesis 2c. Team information acquisition mediates the relationship explicated in Hypothesis 2b.

Hypotheses 2a–2c posit an interaction effect of mean team locus of control and the presence of a team leader on information acquisition and financial performance. We recognize, given Hypotheses 1a–1c, that this interaction might also depend on the locus-of-control dispersion in a team, which implies a complicated three-way interaction. For the sake of parsimony, we focus in our theory section on two-way interactions only, but we tested for the presence of three-way interactions empirically. This is also the case for all subsequent hypotheses.

The benefits of leaders in teams lacking integration. In his detailed field study on top management teams, Hambrick (1995) observed that team fragmentation is a major but virtually unexplored problem that, according to CEOs, undermines the effective functioning of their teams. Fragmented teams do not engage in mutual and collective interaction and are not behaviorally integrated. As a result, such teams have inferior prospects for prompt, adaptive decision making, particularly where coordination is required, because they have great difficulty spotting and agreeing on important challenges and formulating and implementing responses to such challenges (Hambrick, 1995). Fragmentation can be the result of many centrifugal forces, such as the size, scope, and strategy of a firm (Hambrick, 1995). However, the mere microlevel composition of teams in terms of the diversity of member characteristics is also an important factor that might result in team fragmentation. Specifically, in traditional social-psychological theory, heterogeneity among team members is assumed to hamper cognitive and behavioral integration, and ultimately team effectiveness (Shaw, 1981; Wagner, Pfeffer, & O'Reilly, 1984). Recent team composition research, however, shows that this assertion does not hold true for task-related types of team diversity, such as heterogeneity with respect to the functional background of team members (Hendriks, 2004; Jehn et al. 1999; Pelled, Eisenhardt, & Xin, 1999). Such diversity triggers task-related conflict, which enhances sound decision making and team effectiveness (Eisenhardt et al., 1997). However, diversity related to deep differences, such as values and attitudes, appears to be very problematic for effective team functioning, since it triggers emotional conflicts and associated communication problems and role conflicts (Harrison et al., 1998; Jehn et al., 1999). As locus of control is a deep characteristic, we expect that similar problems of team fragmentation and lack of behavioral integration will occur in teams with high locus-of-control diversity.

Indeed, the attitudes and behaviors of internals and externals have been shown to be fundamentally different. Internals are proactive, oriented toward action, and inclined to take risks, while externals are more reactive, passive, and risk averse (Boone, De Brabander, & van Witteloostuijn, 1996; Lefcourt, 1982). Given these attitudinal differences, it is very likely that externals and internals will analyze, interpret, and act upon the same decision situation in different ways. CEOs with a high internal locus of control, for instance, are more inclined to pursue innovative and risky strategies than their counterparts with an external locus of control (Miller, Kets de Vries, & Toulouse, 1982), even when they operate in the same market environment (Boone et al., 1996). In a Prisoner's Dilemma context, externals are less inclined to play cooperatively than internals (Boone, De Brabander, & van Witteloostuijn, 1999), and they learn payoff-maximizing behavior more slowly (Boone, De Brabander, Carree, de Jong, van Olffen, & van Witteloostuijn, 2002). These fundamental differences between internals and externals are likely to cause communication barriers and hamper team integration when internals and externals have to work together. Such deep fragmentation might lead to harmful rivalry in which disagreement on specific decision issues expands to matters of style and personality (Hambrick, 1995). In other words, personalities might become intertwined with issues so that constructive conflicts degenerate into dysfunctional interpersonal conflicts.

What is differentiated has to be integrated for effective performance. This principle applies not only to organizations (Lawrence & Lorsch, 1967), but also to teams (Hambrick, 1995; Priem et al., 1999). Both Eisenhardt and her coauthors (1997) and Hambrick (1995) suggested that team leaders (e.g., CEOs) are extremely important to overcome team fragmentation and to help teams focus on issues and not on personalities. Eisenhardt et al. (1997) argued that although top management teams need a balanced power structure, they at the same time need a relatively powerful CEO to avoid disruptive interpersonal team conflicts. The point is that a leader may facilitate a focus on issues (e.g., by inserting facts in team discussions), help to frame decisions, and create common goals. In a similar vein, Hambrick (1995) pointed to the important role of CEO leader behavior in molding "real" instead of fragmented teams. This is of course all the more important when the likelihood of fragmentation and interpersonal conflict increases owing to deep-level (i.e., locus-of-control) diversity. This hypothesis was recently confirmed in a field study of 38 firms by Hendriks (2004), who demonstrated that centralization of decision making in the hands of the CEOs was positively related to financial organizational performance for top management teams with high locus-of-control dispersion. In the present study, we therefore expected that having a leader would not only be beneficial for external teams (cf. Hypotheses 2a and 2b), but also for teams with high locus-of-control dispersion. Thus,

Hypothesis 3. Leader presence and team financial performance have a positive relationship when team locus-of-control dispersion is high.

As the potential mediating role of information acquisition is highly speculative here, we refrain from proposing a formal hypothesis (hence the question mark in Figure 1). To be sure, deep-level diversity is expected to increase need for information, as objective information represents an important way to achieve cognitive, emotional, and behavioral integration in a team (Eisenhardt et al., 1997). However, an increased need for information when locus-of-control dispersion is high does not necessarily imply that such teams will indeed gather more information. In addition, it is possible that the high need for information associated with team locus-of-control diversity is actually lower for teams that have leaders. Specifically, because a leader serves as a team integration device, she or he might operate as a *substitute* for extensive information gathering to achieve integration in fragmented teams. Teams with high locus-of-control dispersion and leaders might then actually end up with less information than teams with no leaders, which in turn may hamper decision-making effectiveness.

Team leader personality. In discussing the potential benefits of leadership above, as a first step, we only distinguished teams as with and without leaders. However, it is likely that the impact of leaders will depend on their personalities, as well as on their skills and talents. Given that research clearly shows that internals are more astute leaders than externals, in general (Boone et al., 1996; Boone, De Brabander, & Hellemans, 2000), and that their information-processing capacity is more developed (Lefcourt, 1982), we expect that teams with leaders will benefit more when those leaders are people with high internal loci of control (with high internality). Hence,

Hypothesis 4. Leader internality and team financial performance have a positive relationship when mean team externality is high (Hypothesis 2b) and when team locus-of-control dispersion is high (Hypothesis 3).

METHODS

Setting, Procedures, and Data Collection

The data for this study were drawn from a large-scale Dutch multiperiod management simulation called the International Management Competition (IMC). The IMC was launched in 1973 as an in-company training device. Since then, it has been commercialized by a professional game company, continuously developed, and is now played annually, with registration open to teams from any organization inside and outside the Netherlands. Organizations generally enroll teams of (young) managers for training purposes, often as part of their own management development programs. In the 1994 IMC, where we collected our data, 167 teams/companies involving a total of about 700 people actively played the game. Participation costs approximately €2,900 (in 1994 prices) per team (in addition to time consumption), a fee typically paid by team members' employers. Participants are offered a one-day closing seminar, and the winning team wins a business trip to Japan. Thus, teams have rather strong incentives to play seriously. Past evaluations and personal observations indicate well-motivated participants working closely together in playing the game. The fact that only 7 percent of all teams dropped out during the 1994 game corroborates these impressions.

At the heart of the simulation lies an elaborate industry model, containing about 1,400 parameters, which is based on standard economic theory (for details, see van Olffen [1999]). This model makes the game a very sophisticated and realistic simulation of a multifaceted business environment. In the game, small teams run fictitious multiproduct production firms. These teams have to decide on a broad range of business issues, including investments in personnel and machine capacity, raw material purchases, wage levels, efficiency improvements, promotion outlays, product price levels, dividend payments, borrowings, redemptions, customer credit terms, working climate outlays, quality and efficiency R&D expenditures, and much more. Moreover, careful matching of all these elements over time is needed to perform well. Combined, these features make the task of playing the game a challenging one. It is therefore crucial that teams stay abreast of important developments in their environment in order to plan and adjust their actions. In fact, we were assured beforehand by IMC management that it is virtually impossible to be successful in the game without gathering proper information. Teams can buy information on a range of issues. It is this category of team decisions that is of focal interest in the current study.

Not all 167 teams compete with each other. Instead, at the start of the game, the game's management forms random groups of 5 teams each. Each group is the game equivalent of an industry with five competitors. All teams in all industries have exactly the same material and financial starting position, facing identical, fixed game parameter settings. There are no relationships between the industries whatsoever. Teams are well supported during the game: in order to minimize misunderstandings, they receive an extensive game manual and have access to a "helpdesk" in Amsterdam.

The game's objective is to maximize current and future profitability, as well as market shares. Six "decision periods" occur, each lasting two weeks. Decisions are entered on a preformatted form consisting of 37 options. Twenty-three of these pertain to major decision categories like investments in machines, personnel, raw materials, promotion, R&D, and marketing and production targets. The remainder of the decision form concerns 14 specific information requests on, for instance, the effects of promotion outlays, R&D spending, projected market demand, and competitors' prices. At the end of each two-week period, teams have to fax their decision forms to the game's management in Amsterdam, specifying their decisions for the upcoming period. After processing all teams' decisions, game management provides each team with a printed summary of its results for the current period. This feedback includes much free detailed information, including market shares, profit rates, and financial and stock positions. Important for our purposes is that each results summary also contains *specific* information a team has requested, for which it has to pay a fixed per-unit fee. Game management provided us with all the decisions of all teams, including the specific information they requested in each period.

Data collection was logistically challenging. Each team was enrolled under the name of a single contact person. This means that game management could only provide us with the mail addresses and telephone numbers of these people, after which we had to chart the teams surrounding each person ourselves. We did so by sending six copies of our first questionnaire to the contact person, requesting him or her to distribute them among the other team members, collect them, and send them back to us in a supplied envelope. On each questionnaire, we asked participants to state their initials and the size of their team. Upon receipt of questionnaires, we could—by counting and comparing—reconstruct the size of each team and the identity of the members. The contact people, who were very cooperative, cleared up most remaining uncertainties.

We sent out two questionnaires to collect personal and group structure data. As stated, each was mailed to all team contacts who agreed to distribute them among team members. Contact people were reminded twice by phone to have all members respond. The first questionnaire contained questions relating to the members' *backgrounds* in terms of age, education, tenure, former work experience, and team member familiarity. It also included a validated psychological test, measuring locus of control. Three months after the start of the game, team members were asked to individually fill out a second questionnaire regarding *group processes,* such as decision rules, emergent leadership, and extent of participation on the team. To be able to reliably use the group process data from the second questionnaire, we screened teams for individual nonresponse and dropped 14 entire teams in which fewer than 2 members returned the second questionnaire. From the remaining teams, we removed 21 members who did not participate in the ongoing simulation, according to at least 2 fellow team members. After two reminders, we thus ended up with a final reliable sample of 44 teams (26 % of 167), consisting of 193 individuals. A total of 178 of these people (i.e., 92%) returned the second questionnaire. Almost all participants in our sample were Dutch (93%), the remainder coming from such diverse countries as Belgium, Germany, Greece, Hungary, Slovakia, and Switzerland. The sample included only a small minority of women (13%), and about 58 percent held university degrees. The average age was about 34, and age ranged from 21 to 55, with modest variation. The typical participant was a young Dutch male executive with some (about 6 years) in-company business experience. People had known their fellow team members for about 2 years on average, and only one-fifth had ever participated in a management game of this kind before. Teams had an average of 4.39 members (s.d. = 1.02; range = 2–7). Note that only one group in the sample consisted of 2 members. We also performed our analyses excluding this group and found the results to be very similar to the ones reported below. A leader was present in 25 teams (57%).

We performed analyses of variance (ANOVAs) to check whether the 44 teams in our sample differed in important ways from the 123 unselected teams. We found no significant difference (p = .10) between the groups on their average return on investment, profit, total monetary value of information outlays, and total number of information items bought. The absence of significant differences between participating and nonparticipating teams on our major dependent variables made us confident that sampling bias was not a major concern and that our sample was broadly representative.

Dependent and Mediating Variables

Teams could buy information on 14 issues in each period by marking these items on the decision form. *Task information* concerned the impacts of actions, such as the consequences of product R&D for product quality or of process R&D for efficiency, and the "ceteris paribus effect" of advertising expenditures on their market share. These effects were fixed in the game's parameters, time invariant, and equal—but initially unknown—for all firms. *Competitive information* was knowledge of, for instance, competitors' prices, stocks, product quality, and forecasts of demand. Our major mediating variable was simply the *number of different information items* bought in each period. In the last decision period (period 6), buying information was futile, as there was no upcoming period. We therefore only analyzed the number of information items bought in periods 1 through 5, obtaining 220 observations (5 periods $\times$ 44 teams). We decided to analyze the number of information items bought instead of the teams' monetary outlays for information because the latter distribution was highly skewed, posing serious estimation problems owing to outliers. Note, however, that the monetary value of information bought by the teams correlates almost perfectly with the number of information items ($r = .97$, $n = 220$). Results for both measures are almost identical (available upon request). Finally, team financial performance was captured with a standard measure of profitability, *return on equity (ROE),* defined as profit after tax divided by balance sheet equity (see also Boone, van Olffen, & van Witteloostuijn, 1998).

Independent Variables

Individual *locus-of-control* perceptions were measured with a Dutch translation of the well-known and widely used Rotter scale (Rotter, 1966). It contains 37 forced-choice items, 23 of which measure control expectancies and 14 of which are filler items. Respondents have to choose between an internal and an external control alternative. The total Rotter score is obtained by summing the number of *external* control alternatives chosen (with a minimum of 0 and a maximum of 23). The reliability and validity of this Dutch translation have been repeatedly demonstrated (Boone & De Brabander, 1993). Non-Dutch teams received a version that was translated into English and checked by native speakers. Cronbach's alpha for the scale in our sample was .68, which concurs with internal consistencies reported by Rotter (1966) and Robinson and Shaver (1973). This alpha value is very close to .70, which is the lower bound often recommended for research tools (Nunnally, 1978). Two team composition variables were used: the team-level mean and the team-level standard deviation of the Rotter scores, respectively labeled *average external locus of control* and *locus of control heterogeneity.* To facilitate the interpretation of the coefficient estimates, the team average was centered around the sample's mean (Cohen, Cohen, West, & Aiken, 2003).

In order to identify whether or not team *leadership* was present, we asked all team members whether one member, perhaps unintentionally or informally, led team decisions about how to play the game. If a respondent answered yes, we asked the initials of that team member. From these identifications, we calculated for each individual the following ratio: the number of times he or she was identified as leader by another team member divided by the maximum possible number of identifications by others (equals team size minus 1). Team members who scored at least 50 percent on this measure were identified as leaders. This procedure yielded unique leaders in 25 teams. This identification was further validated by the fact that fellow team members rated leaders significantly higher than nonleaders on their (relative) influence on decisions (1, "no influence," to 5, "a lot of influence"). The average individual influence score was 3.38 (s.d. = 0.64, $n = 168$) for nonleaders and 4.13 (s.d. = 0.48, $n = 25$) for leaders ($t = 5.65$, $p < .001$, $n = 191$). Leaders also scored significantly higher on internal locus of control than nonleaders. The average Rotter scores were 8.08 (s.d. = 2.06, $n = 25$) and 9.71 (s.d. = 3.65, $n = 168$) for leaders and nonleaders, respectively ($t = 3.26$, $p < .01$, $n = 191$), levels consistent with earlier research showing that emergent leaders in groups tend to be more internal than nonleaders (Anderson & Schneier, 1978).

Control Variables

We controlled for possible financial constraints on buying information by including a team's *available amount of cash* in each period. *Mean age, age heterogeneity* (i.e., the standard deviation), the *proportion of male members,* and *team size* were included as standard demographic controls. Gender heterogeneity was not included because of the small number of women in the sample and its extremely high correlation ($r = -.92$, $n = 44$) with the teams' mean gender (proportion). We used game *period dummies* to control for between-period variation in the dependent variables. As decision-making quality could be related to team differences in prior knowledge, experience, and motivation, we inserted the following proxies in our models to control for these potential alternative explanations: (1) a dummy indicating whether or not a team was *voluntarily composed* (coded 1 if 75 percent or more of the members indicated the team was so composed, and 0 otherwise), (2) the average *number of years that team members had been acquainted,* (3) the average *number of hours worked together* as a team in each decision period, (4) the proportion of team members with *experience playing similar games,* and (5) the proportion of team members with *university degrees.* Table 1 reports the descriptive statistics of and the correlations among the variables.

Estimation Procedure

The structure of the data is a pooled cross-section and time series ($n = 220$; 44 teams $\times$ 5 periods). Pooled data generally exhibit autocorrelation as the same entities are observed several times. The fixed-effect estimator, which is widely used to account for this problem, could not be applied because our main independent variables did not change over time. Following Baron, Hannan, and Burton (2001), we used Liang and Zeger's (1986) method of generalized estimating equations (GEE), which generalizes quasi-likelihood estimation to the panel data context and is a very flexible way to deal with clustered data (for applied introductions of GEE, see Ballinger [2004; an organization science application] and Zorn [2001; political science]). GEE allows one to take into account different autocorrelation structures by specifying a working correlation matrix. We assumed first-order autocorrelation. We also estimated models with other autocorrelation structures (not shown here). The results of these models were almost exactly the same. Because the observations within the teams could not be assumed to be independent, we also report robust standard errors, using the sandwich estimators developed by Huber (1967) and White (1982).

An important benefit of GEE is that it can easily be applied to dependent variables with different kinds of distributions. In the present case, we noted that our mediating variable, number of information items bought, was not normally distributed. Inspection of the frequencies showed that this count variable followed a Poisson distribution with overdispersion (i.e., the variance was larger than the mean). A common solution to this problem is to estimate a negative binomial model. A drawback of GEE, however, is that the residuals from these models are correlated, making the development of summary goodness-of-fit statistics for GEE models problematic (Ballinger, 2004; Zorn, 2001). Instead, we used (and report) Wald chi-square statistics, which test the null hypothesis that all regression coefficients are equal to zero. As Ballinger (2004: 146) warned, this statistic is not a goodness-of-fit measure, and is, therefore, not suited to comparing the goodness of fit of alternative models. All models were estimated using the XTGEE routine of version 7.0 of STATA.

RESULTS

Table 2 shows the regression estimates of our independent variables on information acquisition and ROE. To assess the extent to which information acquisition acted as a mediator, we followed Baron and Kenny's (1986: 1176) approach (see also James & Brett, 1984). Specifically, information acquisition would be shown to function as a mediator when it met the following conditions: (1) variations in the team-composition-related independent variables significantly accounted for variations in information acquisition (path a in Figure 1), (2) variations in information acquisition significantly accounted for variations in ROE (path b), and (3) the significant relationship between our team-composition-related independent variables and ROE (i.e., the *total* effect) was no longer significant when information acquisition was controlled for; that is, the direct effect was not significantly different from zero (path c). Models 1 and 2 in Table 2 investigate path a. Models 3 and 4 estimate the total effect of our team composition interactions, and model 5 focuses on the total effect of information acquisition (the mediator) on ROE (path b). Finally, Model 6 shows the direct effect of all focal independent and mediating variables (path c). The models in Table 2 only show estimates of all two-way interactions of average external locus of control, locus-of-control heterogeneity, and presence of a leader. For the sake of completeness, we also estimated models including the three-way interaction of those three variables. As none of these estimates turned out to be significant, we do not report them (they are available upon request).

Models 1 and 3 reveal that none of the main effects of the locus-of-control mean and standard deviations are significant. If we had stopped here,

TABLE 1
Descriptive Statistics and Correlations among the Team-Level Variables[a]

Variables	Mean	s.d.	Minimum	Maximum	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Cash balance at beginning of period	1,145.53	2,667.83	−4,076.40	12,004.40														
2. Team size	4.39	1.02	2.00	7.00	−.26†													
3. Team voluntarily composed	0.80	0.41	0.00	1.00	−.07	.03												
4. Average number of years acquainted	2.02	1.63	0.28	7.33	−.09	−.19	.15											
5. Number of hours worked as a team	3.13	1.54	0.92	8.50	.18	−.21	−.17	−.18										
6. Proportion of members with game experience	0.22	0.26	0.00	1.00	−.08	.11	−.13	.22	.13									
7. Proportion of members with university degrees	0.60	0.35	0.00	1.00	−.01	−.21	−.17	−.13	.04	−.08								
8. Proportion of male members	0.86	0.18	0.33	1.00	−.21	.24	.02	.05	−.06	−.16	−.18							
9. Average age	34.13	5.95	22.80	50.67	.05	−.11	.04	.58**	−.11	−.08	−.04	.31*						
10. Age heterogeneity	4.44	2.31	0.58	9.56	.19	.06	−.02	.02	.06	−.20	−.14	.12	.53**					
11. Average external locus of control	9.43	1.59	5.50	12.25	.07	.16	−.04	−.14	−.06	.05	−.14	−.01	−.15	−.09				
12. Locus-of-control heterogeneity	3.34	1.23	0.00	6.08	−.37*	.34*	−.14	−.16	−.15	−.06	.17	.31*	−.06	−.05	.32*			
13. Presence of a leader[b]	0.57	0.50	0.00	1.00	.10	.06	−.10	−.11	.04	.22	.28†	.07	.01	−.06	.08	.13		
14. Number of information items acquired	5.00	2.93	0.60	11.8	.02	.19	−.02	−.21	.07	.24	−.10	.18	−.12	−.05	.05	.03	.21	
15. Return on equity	1.08	1.68	−2.53	6.51	−.10	.22	.02	−.17	−.04	.02	.05	.29†	−.20	−.25	.13	.11	.06	.44**

[a] Variables that varied per period were averaged at the team level so that *n* equals 44 throughout.
[b] Coded 0/1.
† $p < .10$
* $p < .05$
** $p < .01$
Two-sided tests.

TABLE 2
Information Acquisition and Return on Equity (Hypotheses 1–3)[a, b, c]

Variables	Model 1: Number of Information Items$_t$	Model 2: Number of Information Items$_t$	Model 3: ROE$_{t+1}$	Model 4: ROE$_{t+1}$	Model 5: ROE$_{t+1}$	Model 6: ROE$_{t+1}$
Constant	0.89 (0.98)	0.51 (0.96)	3.04 (2.69)	2.97 (2.44)	2.80 (2.68)	2.89 (2.60)
Period 2	−0.38** (0.09)	−0.42** (0.09)	−5.11** (0.75)	−5.11** (0.75)	−5.58** (0.77)	−5.38** (0.78)
Period 3	−0.31** (0.09)	−0.38** (0.10)	−1.50* (0.73)	−1.51* (0.73)	−1.65* (0.72)	−1.59* (0.73)
Period 4	−0.39** (0.09)	−0.45** (0.09)	−0.83 (0.71)	−0.84 (0.71)	−0.97 (0.70)	−0.91 (0.70)
Period 5	−0.57** (0.11)	−0.63** (0.12)	−0.25 (0.58)	−0.25 (0.58)	−0.26 (0.56)	−0.26 (0.57)
Cash balance at beginning of period	5.5 E-5** (6.0 E-6)	5.4 E-5** (6.5 E-6)	−0.0001** (2.7 E-5)	−0.0001** (2.8 E-5)	−0.0001** (2.7 E-5)	−0.0001** (2.8 E-5)
Team size	0.07 (0.10)	0.20** (0.08)	0.30 (0.37)	0.49 (0.32)	0.27 (0.36)	0.43 (0.32)
Team voluntarily composed	0.01 (0.21)	−0.23 (0.19)	−0.33 (0.68)	−1.01 (0.66)	−0.40 (0.68)	−0.89 (0.67)
Average number of years acquainted	−0.10 (0.08)	0.04 (0.07)	−0.12 (0.31)	−0.21 (0.30)	0.002 (0.29)	0.21 (0.29)
Number of hours worked as a team per period	0.002 (0.05)	−0.07 (0.04)	−0.02 (0.18)	−0.23 (0.19)	−0.02 (0.16)	−0.18 (0.19)
Proportion of members with game experience	0.45 (0.36)	0.63 (0.30)	−0.60 (1.21)	0.27 (1.14)	−1.31 (1.12)	−0.37 (1.26)
Proportion of members with university degrees	−0.29 (0.31)	0.06 (0.26)	−0.34 (1.20)	0.46 (1.22)	−0.15 (1.12)	0.39 (1.19)
Proportion of male members	0.86 (0.55)	0.30 (0.57)	2.65 (1.99)	1.97 (2.14)	1.97 (1.94)	1.67 (2.15)
Average age	0.001 (0.02)	−0.04 (0.03)	−0.003 (0.10)	−0.09 (0.10)	−0.009 (0.09)	−0.07 (0.10)
Age heterogeneity	−0.02 (0.05)	0.06 (0.05)	−0.32* (0.19)	−0.15 (0.17)	−0.30* (0.18)	−0.18 (0.18)
Average external locus of control[d]	−0.01 (0.07)	−0.61** (0.16)	0.16 (0.22)	−1.30* (0.60)	0.16 (0.21)	−0.99 (0.65)
Locus-of-control heterogeneity	0.02 (0.08)	0.34** (0.11)	−0.19 (0.35)	0.43 (0.47)	−0.15 (0.30)	0.29 (0.49)
Presence of a leader[e]	0.24 (0.17)	1.69** (0.51)	0.35 (0.72)	3.49* (1.80)	0.17 (0.69)	2.54 (1.84)
Average external locus of control × locus-of-control heterogeneity		0.13** (0.03)		0.31* (0.15)		0.25 (0.15)
Average external locus of control × presence of a leader		0.34** (0.12)		0.89* (0.42)		0.66 (0.44)
Locus-of-control heterogeneity × presence of a leader		−0.49** (0.14)		−1.07* (0.54)		−0.78 (0.57)
Number of information items$_t$					0.21** (0.07)	0.12 (0.07)
Model Wald chi-square	294.19**	434.21**	190.53**	263.72**	232.74**	268.89**

[a] The method of generalized estimating equations (GEE) was used to estimate the parameters of the models. First-order autocorrelation over time was assumed within teams. Models 1 and 2 report negative binomial regression estimates.

[b] Robust standard errors are reported in parentheses (based on the Huber-White sandwich estimator of variance to take into account that the observations within the teams cannot be assumed to be independent).

[c] Forty-four teams played six periods (n = 264). However, as we had to lag the number of information items bought by the teams to assess the causal impact of information search on ROE, 44 observations were lost, leaving us with 220 observations (periods 1–5 × 44 teams for number of information items bought, and period 2–6 × 44 teams for ROI).

[d] Centered

[e] Coded 0/1.

$^{*}p < .05$

$^{**}p < .01$

One-sided tests.

we would have concluded that team composition in terms of locus of control does not matter with respect to information acquisition behavior and team financial performance. However, the other models show that this conclusion is very premature, as each and every interaction effect appears to be significant.

Hypotheses 1a–c are clearly confirmed, as the regressions of models 2 and 4 in Table 2 show (1) a significant, negative effect of mean external locus of control and (2) a significant, positive effect of the product of the mean and the standard deviation (locus-of-control heterogeneity) on both information acquisition and ROE. In addition, the coefficient of that product becomes insignificant when information acquisition is added to model 4 (see model 6), providing evidence for mediation. Note that the coefficient of average external locus of control estimates the impact of mean externality when a team's standard deviation is zero and the team has no leader. So, internal homogeneous teams with no leader gather more information and therefore achieve higher financial performance. However, this effect decreases if the standard deviation increases. This follows from the positive and significant effect of the product term of average external locus of control and locus-of-control heterogeneity.

To illustrate this interaction, we plotted the predicted value of ROE as a function of mean external locus of control for different values of a team's standard deviation; Figure 2 shows these slopes. The estimates of model 4 were used for this purpose, and predicted values were calculated at the means of the other independent variables. The pattern for our mediating variable, information acquisition, is similar, and therefore these figures are not reported here. The same two remarks apply to Figures 3 and 4, presented below. To compare teams with low and high locus-of-control heterogeneity, we calculated the standard deviation of the 44 teams' scores on locus-of-control heterogeneity. This standard deviation equals 1.23 (see Table 1). In Figure 2, "low" and "high" refer to values of one standard deviation below or above the average team's locus-of-control heterogeneity.

Figure 2 reveals that the estimated interaction between average external locus of control and locus-of-control heterogeneity is nonmonotonic. That is, an increase in the within-team standard deviation lowers ROE for teams with a low mean (i.e., internal teams). The opposite appears to be the case for teams with a high mean (i.e., external teams). This pattern is consistent with our argument that adding external individuals to internal teams, which ceteris paribus increases the teams' standard deviation, reduces their information-processing capacity and therefore also their financial performance. Conversely, it follows that adding internal individuals to external teams increases the teams' information-processing capacity and effectiveness.

Models 2 and 4 show that having a leader is positively related to information acquisition behavior and ROE (the coefficient of the variable *presence of a leader* is significant and positive). Note that this coefficient is the estimate of the effect of having a leader for teams with an average mean locus-of-control score (as average external locus of control is centered around the sample's average), and for teams with zero locus-of-control heteroge-

FIGURE 2
Interaction of Average External Locus of Control and Locus-of-Control Heterogeneity (Hypotheses 1a–1c)

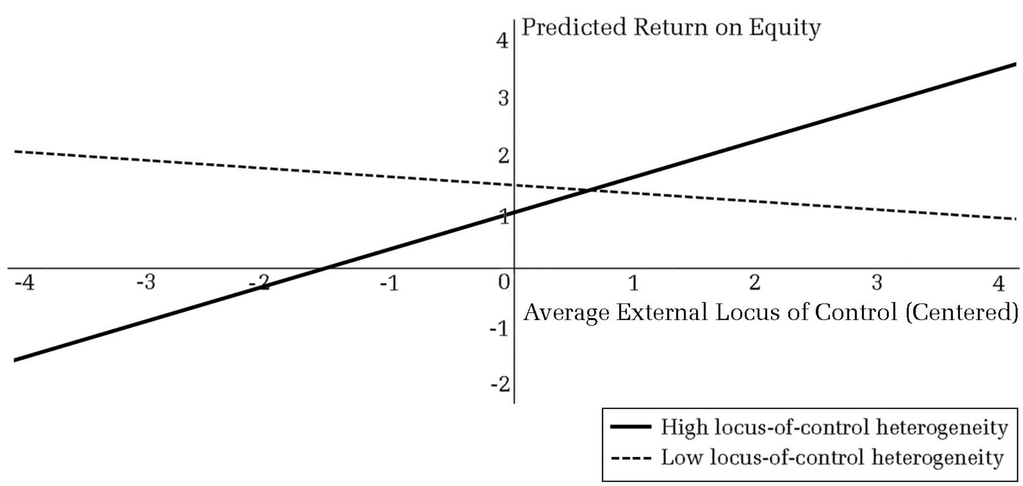


FIGURE 3
Interaction of Average External Locus of Control and Leadership Structure (Hypotheses 2a–2c)

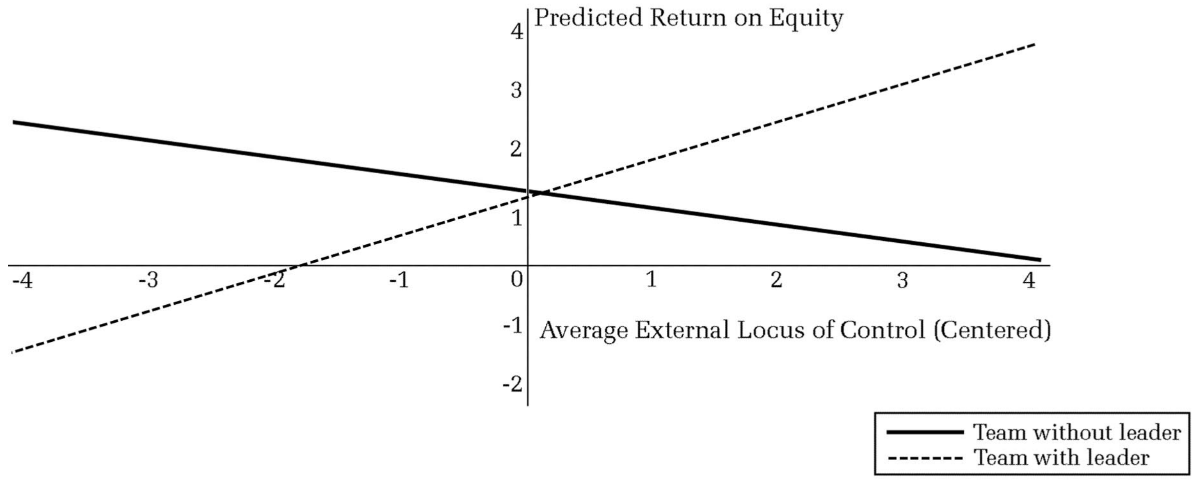
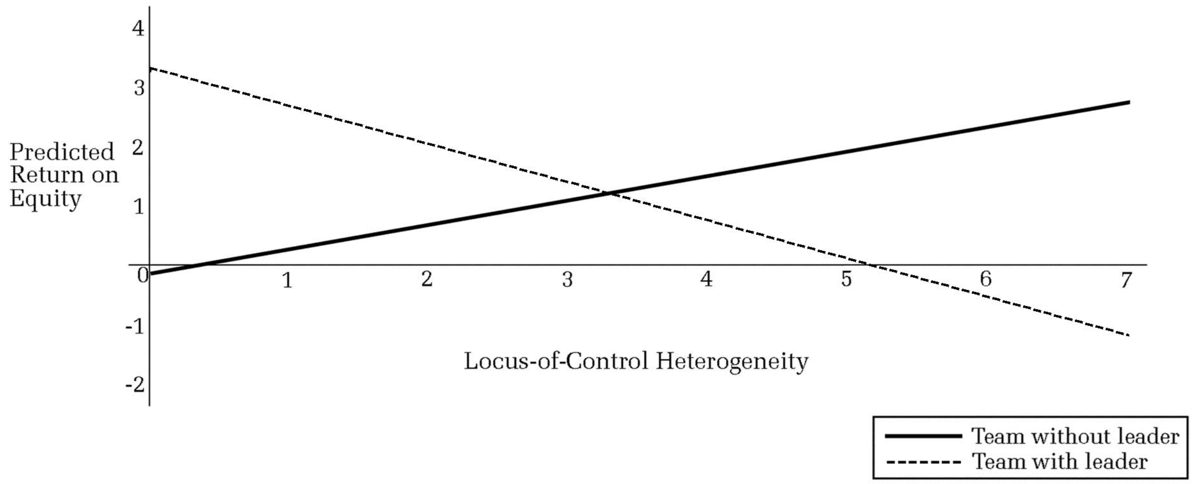


FIGURE 4
Interaction of Locus-of-Control Heterogeneity and Leadership Structure (Total Effect)



neity. This finding is consistent with our argument that having a leader increases the vertical information-processing capacity of a team. Important for Hypotheses 2a–c is the significant and positive effect of the product of average external locus of control and leader presence, indicating that the impact of having a leader is larger for external teams. This is again the case for both information acquisition and ROE. Given that the impact of the product of average external locus of control and leader presence disappears when information acquisition is added to model 4 (see the insignificant coefficient in model 6), we conclude that Hypotheses 2a–c are also clearly confirmed.

In Figure 3, we graphically represent the impact of average external locus of control on predicted ROE for teams with and without leaders. This graph shows that a team with a high average external locus-of-control score performs better when it has a leader, whereas the opposite is the case for an internal team.

Hypothesis 3 was not confirmed, as the interaction of locus-of-control heterogeneity and presence of a leader is significantly related to ROE in model 4, but with a negative sign, whereas we predicted a positive coefficient. Apparently, heterogeneous teams do not benefit more from having a leader but, on the contrary, benefit less. Interestingly, we also find a similar significant, negative interaction of locus-of-control heterogeneity and presence of a leader in the information acquisition equation (model 2). As speculated in the theory section, heterogeneous teams seem to collect less information when they have leaders. These teams also had lower returns on equity (ROEs), probably as a byproduct of having less information. The latter is suggested by the fact that the total effect on ROE of locus-of-control heterogeneity multiplied by the presence of a leader is significantly negative in model 4, but becomes insignificant when information acquisition is added (see model 6).

Figure 4 illustrates the total effect of locus-of-control heterogeneity on ROE for teams with and without leaders. Figure 4 shows that the interaction between locus-of-control heterogeneity and presence of a leader is nonmonotonic. The locus-of-control standard deviation is positively related to ROE for leaderless teams. However, the opposite is the case for teams with leaders, which is difficult to explain. The same pattern can be observed for information acquisition. Apparently, heterogeneous teams do not need, or at least collect less, information than homogeneous teams when they do have leaders. Having a leader only stimulates information gathering in homogeneous teams, perhaps because structuring information processing is more difficult in heterogeneous than in homogeneous teams.

We reestimated the models in Table 2 for the 25 teams that reported having leaders in order to test whether the locus of control of a leader matters in determining information acquisition and ROE (cf. Hypothesis 4). Obviously, models 1 and 4 of Table 3 confirm the findings presented above, indicating that in teams with leaders, average team externality is positively associated with information acquisition and ROE, and locus-of-control heterogeneity is negatively associated with those variables (see Figures 3 and 4).

Note that leader locus of control is not associated with either outcome variable (models 2 and 5 in Table 3), and that it does not moderate the impact of average external locus of control and locus-of-control heterogeneity, as both interaction terms are insignificant. As a result, Hypothesis 4 should be rejected. We suspect that this is because the emergent leaders in the present study were more internal than the average team member (see Methods), restricting the range of locus of control among the team leaders. This range restriction made it more difficult to detect any effect.

DISCUSSION AND APPRAISAL

Our empirical results clearly confirm the necessity to go beyond simple main effects of team composition variables. In fact, analyzing main effects only would have led us to conclude that team composition does not matter. Including the basic moderator variables, however, significantly and consistently increased the explanatory power of our models. The findings underscore the importance of carefully considering the aggregation rules one uses to derive team composition variables (Chan, 1998). Specifically, when theories describing behavior at the individual level are invoked to predict outcomes at the team level, one needs to recognize that the mean of a certain characteristic is not adequate to predict team behavior, since the impact of the mean will depend on the diversity of that characteristic within the team (and vice versa, as interactions are symmetric). Additionally, the findings confirm that the impact of the team composition variables delicately depends on leadership structure. Taking these findings together, we conclude that many team composition data are probably underanalyzed. It is not unlikely that many nonsignificant findings in previous research are due to the omission of important moderators. In addition, "hidden" moderators might also account for the many inconsistencies found in prior work. This likelihood is nicely illustrated by our finding that diversity in locus of control increases information acquisition behavior and team financial performance for leaderless teams but decreases both outcome variables when teams have leaders.

Additionally, our main findings contribute to locus-of-control research (in a team context) in two ways. First, the well-documented fact that internal individuals are better at information processing than external individuals appears to be true at the group level of analysis as well. Specifically, adding internals to a team (without increasing the standard deviation) is likely to increase the team's information-processing capacity, resulting in more information acquisition behavior and, as a result, better team performance. Second, the findings show that a leader might serve as a substitute for the relatively low information-processing capacity of an external team. External teams clearly gain effectiveness from having leaders. These findings have interesting implications for managerial practice because they suggest the importance of fitting group processes and structures with the personality distribution within a team.

Bearing out traditional contingency theory, there does not seem to be a best way to structure a team. With respect to locus of control, it is important to create within-group settings that naturally fit with the needs and capacities associated with the deep-level characteristics of team members. When members have an internal locus of control, self-organization is likely to lead to superior team performance. If, however, most members have an external

TABLE 3
Impact of Leader's Locus of Control (Hypothesis 4)[a, b, c]

Variables	Model 1: Number of Information Items$_t$	Model 2: Number of Information Items$_t$	Model 3: Number of Information Items$_t$	Model 4: ROE$_{t+1}$	Model 5: ROE$_{t+1}$	Model 6: ROE$_{t+1}$
Constant	1.95 (1.21)	2.15* (1.30)	4.39 (3.74)	2.92 (3.56)	2.29 (3.57)	−5.94 (8.41)
Period 2	−0.36** (0.09)	−0.37** (0.09)	−0.39** (0.10)	−5.57** (0.89)	−5.57** (0.89)	−5.57** (0.89)
Period 3	−0.34** (0.12)	−0.35** (0.12)	−0.39** (0.11)	−2.41** (0.85)	−2.41** (0.84)	−2.43** (0.84)
Period 4	−0.38** (0.11)	−0.38** (0.11)	−0.36** (0.10)	−0.90 (0.76)	−0.89 (0.74)	−0.91 (0.74)
Period 5	−0.35** (0.10)	−0.35** (0.10)	−0.36** (0.10)	−0.58 (0.52)	−0.58 (0.52)	−0.59 (0.52)
Cash balance at beginning of period	0.00004** (4.3 E-6)	0.00004** (4.5 E-6)	0.00004** (4.3 E-6)	−0.001** (4.0 E-5)	−0.001** (4.0 E-5)	−0.001* (4.4 E-5)
Team size	0.12 (0.11)	0.11 (0.11)	0.12 (0.13)	0.95* (0.43)	0.97** (0.41)	1.02** (0.42)
Team voluntarily composed	−0.27 (0.27)	−0.26 (0.28)	−0.27 (0.29)	−1.17* (0.65)	−1.22* (0.68)	−1.21* (0.65)
Average number of years acquainted	−0.14 (0.10)	−0.13 (0.11)	−0.08 (0.12)	−0.31 (0.37)	−0.33 (0.35)	−0.50* (0.29)
Number of hours worked as a team per period	−0.06 (0.07)	−0.06 (0.06)	−0.05 (0.07)	−0.24 (0.20)	−0.23 (0.20)	−0.24 (0.19)
Proportion of members with game experience	0.99** (0.32)	1.02** (0.34)	0.95** (0.34)	3.20** (1.28)	3.11* (1.48)	3.17* (1.46)
Proportion of members with university degrees	0.31 (0.29)	0.30 (0.29)	0.36 (0.29)	4.05** (1.02)	4.08** (0.97)	3.97** (0.92)
Proportion of male members	0.48 (0.48)	0.51 (0.50)	0.46 (0.59)	7.49** (1.87)	7.39** (1.99)	7.99** (1.93)
Average age	0.002 (0.03)	−0.001 (0.03)	−0.02 (0.04)	−0.07 (0.10)	−0.06 (0.10)	−0.003 (0.10)
Age heterogeneity	−0.02 (0.05)	0.004 (0.06)	0.03 (0.07)	−0.64** (0.16)	−0.66** (0.17)	−0.76** (0.18)
Average external locus of control[d]	0.22** (0.05)	0.23** (0.06)	0.23 (0.25)	0.87** (0.21)	0.85** (0.25)	0.59 (0.76)
Locus-of-control heterogeneity	−0.28** (0.10)	−0.29** (0.10)	−0.80 (0.65)	−1.68** (0.37)	−1.66** (0.40)	0.10 (1.79)
Leader external locus of control		−0.01 (0.05)	−0.26 (0.31)		0.04 (0.21)	0.90 (0.85)
Average external locus of control × leader external locus of control			−0.006 (0.03)			0.04 (0.11)
Locus-of-control heterogeneity × leader external locus of control			0.07 (0.09)			−0.24 (0.25)
Model Wald chi-square	157.02**	155.10**	227.34**	384.21**	751.11**	1,464.56**

[a] GEE was used to estimate the parameters of the models. First-order autocorrelation over time was assumed within teams. Models 1, 2, and 3 report negative binomial regression estimates.

[b] Robust standard errors are reported in parentheses (based on the Huber-White sandwich estimator of variance to take into account that the observations within the teams cannot be assumed to be independent).

[c] Twenty-five teams reported having leaders. As a result, the number of observations in Table 3 is restricted to 125 (25 × 5) instead of 220.

[d] Centered.

* $p < .05$

** $p < .01$

One-sided tests.

locus of control, appointing a leader to guide team members seems to be very important. Thus, an important road to improved team effectiveness might be the design of what could be called "natural" team configurations—natural in the sense that externals actually like to work in structured situations with leadership, while internals prefer uncertainty and individual agency. Building such configurations may lead to the achievement of a remarkable equilibrium outcome in which team effectiveness, member well-being and member satisfaction overlap. Managers have more freedom to enhance team effectiveness than originally thought. The difficult task of composing optimal teams by the careful selection of members with specific characteristics can be circumvented by designing team structures that fit a given team composition. In more general terms, these findings suggest how team composition can be balanced with team structure to increase team potency, a major determinant of team effectiveness (Shea & Guzzo, 1987).

With respect to locus-of-control diversity, our findings appear to be more difficult to interpret. First, teams that were heterogeneous as to members' locus of control did not perform better when they had leaders in the present setting, contrary to our prediction. This finding is at odds with Hendriks's (2004) findings in a field setting, showing that organizations perform better when deep locus-of-control "differentiation" is "integrated" with centralized decision making. A possible explanation follows from Harrison and his coauthors (1998), who showed that it takes time for group members to discover deep-level characteristics. It may be that people in the simulation used for this study did not spend enough time together to get to know each other sufficiently well for harmful interpersonal conflicts to be unleashed. In addition, the real-world top management teams in the Hendriks (2004) study were not only responsible for formulating strategies, but also for implementing them. In the simulation, the only task of the team members was to formulate strategic and operational decisions, while field implementation was not an issue. Perhaps deep-level differences need leadership especially when people have to work together to make strategies work on an ongoing, day-to-day basis.

Notwithstanding these observations, locus-of-control diversity did appear to be related to information acquisition, but only for teams without leaders. Given the absence of any related evidence in prior research to support this finding, we can only speculate about the underlying reason. We suggest that heterogeneous teams collect more information for the simple reason that they need more information in order to reconcile the different perceptions and attitudes that result from deep differences (irrespective of whether interpersonal conflict occurs or not). This need, however, is reduced when a team has a leader because then the leader can serve as a substitute for extensive information gathering to achieve team integration. Paradoxically, at least in the present decision-making context, heterogeneous teams with leaders ended up with less information, and therefore appeared to be less effective. These speculations at least underscore Eisenhardt and colleagues' (1997) observation that information is extremely important in helping teams to focus on facts and not on personalities. Those authors also made it clear that to understand the subtle impact of different types of diversity in different settings, both more theoretical work and more in-depth empirical observational team studies (cf. Eisenhardt et al., 1997; Hambrick, 1995) are required.

We want to point to a few additional interesting avenues for further research. First, our findings indicate that Priem and colleagues' (1999) call to avoid sacrificing construct validity for reliable measurement of demographic characteristics is justified. Future research should therefore focus on other substantive personality characteristics and underlying values of team members in order to increase the explanatory power of team composition models. Many deep-level characteristics have not yet been studied in a team context, such as sensation seeking (Zuckerman, 1979), self-monitoring (Snyder, 1974), and value orientation (Schwartz & Bilsky, 1990). Teams that are differently composed in terms of these fundamental characteristics are likely to produce different outcomes. The outcomes under study should be carefully selected and adapted to the chosen characteristics in a meaningful way. As Priem and colleagues (1999) put it, a focus on substantive dimensions requires adaptations in theory prescription. Team processes are far too complex to allow researchers to build general theories with respect to the impact of team composition variables.

Second, when past researchers have incorporated moderator variables in their designs, they have mainly focused on external contingencies. For instance, studies have tested whether or not the benefits of team diversity are larger in dynamic than in stable industries (Bantel & Jackson, 1989; Halebian & Finkelstein, 1993; Hambrick, Cho, & Chen, 1996). Surprisingly enough, the number of studies focusing on internal (to a team) contingencies, as does the present study, is extremely limited. Our findings illustrate the saliency of these types of moderators. Many other important basic internal contingencies that directly impinge on the needed distribution of attitudes, skills, and knowledge in a team deserve more attention: these include the characteristics of the team's task (Jehn et al., 1999), the distribution of power within the team (Priem et al., 1999), and the intrateam division of labor. For example, we expect that an organization with a functional type of departmentalization would benefit greatly from being managed by a top management team with high functional background diversity. However, a multidivisional organization may benefit from having many general managers, each responsible for a business unit, in its top management team, implying low functional background diversity. Team composition research can progress by adopting such an approach, in that its value for managerial practice, which is now considered to be low (Priem et al., 1999), would clearly increase, because variables such as team structure and division of labor are amenable to managerial design. Systematic studies of this kind would help managers build sustainable team configurations for effective performance.

To conclude, we would like to end the article by mentioning two limitations of our study. First, research that straddles levels of analysis faces the difficult task of explicating the theoretical underlying mechanisms that link individual behavior with group-level aggregated outcomes (Chan, 1998). In the present case, we tried to build an argument on how locus-of-control personality, via individual attitudes and behavior, affects team-level information acquisition and effectiveness. In explicating these links, we also invoked other important underlying mechanisms such as group-level feelings of potency and information-processing capacity, both assumed to be influenced by team locus-of-control composition. A full-blown empirical study would try to measure as many putative mediating mechanisms as possible. Taking a parsimonious first step, however, we decided to only measure straightforward "objective" team outcomes. To increase understanding, future research might do well to also incorporate team members' subjective ratings of, for instance, a team's ability to adequately deal with and integrate information, and the degree of the team's potency.

Second, we acknowledge that our conclusions are based on data obtained from a business simulation game, which inevitably reduces the external validity of our findings. We nevertheless opted for this approach as a first step for pragmatic reasons. First, personality data on entire teams are difficult to collect in a field setting, especially in the realm of (top) management teams. This is probably why so few studies in this area focus on deep-level characteristics. Second, the simulation environment allowed us to carefully connect information acquisition behavior to actual team effectiveness outcomes, which is in all likelihood undoable in a field setting. We believe, however, that the advantages of having team personality data and detailed objective information on actual team behavior and performance outweigh the disadvantage of reduced external validity. In this respect, we agree with Plott's (1988) observation that an experiment (in the present case, a simulation) is always a fair test of a theory because if it is correct, it should hold in a laboratory setting. Conversely, if a theory is falsified in relatively controlled settings, there is surely something wrong with the theory.

REFERENCES

Abel-Halim, A. A. 1981. Personality and task moderators of subordinate responses to perceived leader behavior. ***Human Relations,*** 34: 73–88.

Anderson, C. R., & Schneier, C. E. 1978. Locus of control, leader behavior, and leader performance among management students. ***Academy of Management Journal,*** 21: 690–698.

Andrisani, P. J., & Nestel, G. 1976. Internal-external control as contributor to and outcome of work experience. ***Journal of Applied Psychology,*** 61: 156–165.

Ballinger, G. A. 2004. Using generalized estimating equations for longitudinal data analysis. ***Organizational Research Methods,*** 7: 127–150.

Bantel, K. A., & Jackson, S. E. 1989. Top management and innovations in banking: Does the composition of the top team make a difference? ***Strategic Management Journal,*** 10: 107–124.

Baron, J. N., Hannan, M. T., & Burton, M. D. 2001. Labor pains: Organizational change and employee turnover in young, high-tech firms. ***American Journal of Sociology,*** 106: 960–1012.

Baron, R. M., & Kenny, D. A. 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. ***Journal of Personality and Social Psychology,*** 51: 1173–1182.

Barrick, M. R., Stewart, G. L., Neubert, M. J., & Mount, M. K. 1998. Relating member ability and personality to work-team processes and team effectiveness. ***Journal of Applied Psychology,*** 83: 377–391.

Boone, C., & De Brabander, B. 1993. Generalized versus specific locus of control expectancies of chief executive officers. ***Strategic Management Journal,*** 14: 619–626.

Boone, C., De Brabander, B., Carree, M., de Jong, G., van Olffen, W., & van Witteloostuijn, A. 2002. Locus of control and learning to cooperate in a Prisoner's

Dilemma game. ***Personality and Individual Differences,*** 32: 929–946.

Boone, C., De Brabander, B. & Hellemans, J. 2000. Locus of control and small-firm performance: A research note. ***Organization Studies,*** 21: 641–646.

Boone, C., De Brabander, B. & van Witteloostuijn, A. 1996. CEO locus of control and small firm performance: An integrative framework and empirical test. ***Journal of Management Studies,*** 33: 667–699.

Boone, C., De Brabander, B., & van Witteloostuijn, A. 1999. The impact of personality on behavior in five Prisoner's Dilemma games. ***Journal of Economic Psychology,*** 20: 343–377.

Boone, C., van Olffen, W., & van Witteloostuijn, A. 1998. Psychological team make-up as a determinant of economic firm performance: An experimental study. ***Journal of Economic Psychology,*** 19: 43–73.

Brownell, P. 1981. Participation in budgeting: Locus of control and organizational effectiveness. ***Accounting Review,*** 56: 844–860.

Brownell, P. 1982. The effects of personality-situation congruence in a managerial context: Locus of control and budgetary participation. ***Journal of Personality and Social Psychology,*** 42: 753–763.

Chan, D. 1998. Functional relations among constructs in the same content domain at different levels of analysis: A typology of composition models. ***Journal of Applied Psychology,*** 83: 234–246.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. 2003, ***Applied multiple regression/ correlation analysis for the behavioral sciences*** (3rd ed.). Hillsdale, NJ: Erlbaum.

Eisenhardt, K. M., Kahwajy, J. L., & Bourgeois, L. J. 1997. How management teams can have a good fight. ***Harvard Business Review,*** 75(4): 77–85.

Finkelstein, S. 1992. Power in top management teams: Dimensions, measurement, and validation. ***Academy of Management Journal,*** 35: 505–538.

Finkelstein, S., & Hambrick, D. C. 1996. ***Strategic leadership: Top executives and their effects on organizations,*** St. Paul: West.

Galbraith, J. 1973. ***Designing complex organizations***. Reading, MA: Addison-Wesley.

Govindarajan, V. 1988. A contingency approach to strategy implementation at the business-unit level: Integrating administrative mechanisms with strategy. ***Academy of Management Journal,*** 31: 828–853.

Govindarajan, V. 1989. Implementing competitive strategies at the business unit level: Implications of matching managers to strategies. ***Strategic Management Journal,*** 10: 251–270.

Haleblian, J., & Finkelstein, S. 1993. Top management team size, CEO dominance, and firm performance: The moderating roles of environmental turbulence and discretion. ***Academy of Management Journal,*** 36: 844–863.

Hambrick, D. C. 1995. Fragmentation and the other problems CEOs have with their top management teams. ***California Management Review,*** 37(3): 110–127.

Hambrick, D. C., & Mason, P. A. 1984. Upper echelons: The organization as a refection of its top managers. ***Academy of Management Review,*** 9: 193–206.

Hambrick, D. C., Geletkanycz, M. A., & Fredrickson, J. W. 1993. Top management commitment to the status quo: Some tests of its determinants. ***Strategic Management Journal,*** 14: 401–418.

Hambrick, D. C., Cho, T., & Chen, M.-J. 1996. The influence of top management team heterogeneity on firms' competitive moves. ***Administrative Science Quarterly,*** 41: 659–684.

Harrison, D., Price, K., & Bell, M. 1998. Beyond relational demography: Time and the effects of surface- and deep-level diversity of work group cohesion. ***Academy of Management Journal,*** 41: 96–107.

Hendriks, W. 2004. ***Top management team diversity and firm performance. An empirical research into IT firms.*** Unpublished doctoral dissertation, University of Maastricht, the Netherlands.

Huber, P. J. 1967. The behavior of maximum likelihood estimates under non-standard conditions. In L. M. Le Cam & J. Neyman (Eds.), ***Proceedings of the fifth Berkeley symposium in mathematical statistics, and probability***: 221–233. Berkeley and Los Angeles: University of California Press.

James, L. R., & Brett, J. M. 1984. Mediators, moderators, and tests for mediation. ***Journal of Applied Psychology,*** 69: 307–321.

Jehn, K. A., & Mannix, E. A. 2001. The dynamic nature of conflict: A longitudinal study of intragroup conflict and group performance. ***Academy of Management Journal,*** 44: 238–251.

Jehn, K. A., Northcraft, G. B., & Neale, M. A. 1999. Why differences make a difference: A field study of diversity, conflict, and performance in workgroups. ***Administrative Science Quarterly,*** 44: 741–763.

Karabenick, S. A., & Addy, M. M. 1979. Locus of control and sex differences in skill and chance risk-taking conditions. ***Journal of General Psychology,*** 100: 215–228.

Lawrence, B. S. 1997. Opening the black box of organizational demography. ***Organization Science,*** 8: 1–22.

Lawrence, P., & Lorsch, J. 1967. ***Organization and environment***. Cambridge, MA: Harvard University Press.

Leavitt, H. 1951. Some effects of communication patterns on group performance. ***Journal of Abnormal and Social Psychology*** 46: 38–50.

Lefcourt, H. M. 1982. ***Locus of control: Current trends in theory and research***. Hillsdale, NJ: Erlbaum.

Liang, K-Y., & Zeger, S. L. 1986. Longitudinal data analysis using generalized linear models. ***Biometrika,*** 73: 13–22.

Mackenzie, K. D. 1978. ***Organizational structures***. Arlington Heights, IL: AHM Publishing.

Miller, D., Kets de Vries, M. R., & Toulouse, J. M. 1982. Top executive locus of control and its relationship to strategy-making, structure and environment. ***Academy of Management Journal,*** 25: 237–253.

Miller, D., & Toulouse, J. M. 1986. Strategy, structure, CEO personality and performance in small firms. ***American Journal of Small Business,*** 10(3): 47–62.

Mintzberg, H. 1979. ***The structuring of organizations: A synthesis of the research***. Englewood Cliffs, NJ: Prentice-Hall.

Mitchell, T. R., Smyser, C. M., & Weed, S. E. 1975. Locus of control: Supervision and work satisfaction. ***Academy of Management Journal,*** 18: 623–631.

Nunnally, J. C. 1978. ***Psychometric theory*** (2nd ed.). New York: McGraw-Hill.

O'Brian, G. E. 1984. Locus of control, work, and retirement. In H. M. Lefcourt (Ed.), ***Research with the locus of control construct: Extensions and limitations,*** vol. 3: 7–68. New York: Academic Press.

Van Olffen, W. 1999. ***Team level locus of control and competitive team behavior: An experimental study*** (doctoral dissertation, Maastricht University). Maastricht, the Netherlands: Datawyse.

Pelled, L. 1996. Demographic diversity, conflict, and work group outcomes: An intervening process theory. ***Organization Science,*** 7: 615–631.

Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. 1999. Exploring the black box: An analysis of work group diversity, conflict, and performance. ***Administrative Science Quarterly,*** 44: 1–28.

Pfeffer, J. 1983. Organizational demography. In L. L. Cummings & B. M. Staw (Eds.), ***Research in organizational behavior,*** vol. 5: 299–357. Greenwich, CT: JAI Press.

Phares, E. J. 1976. ***Locus of control in personality***. Morristown, NJ: General Learning Press.

Plott, C. R. 1989. An updated review of industrial organization: Application of experimental methods. In R. Schmalensee & R. Willig (Eds), ***Handbook of industrial organization,*** vol. 2: 1109–1176. Amsterdam: North Holland.

Polzer, J. T., Milton, L. P., & Swann, W. B. 2002. Capitalizing on diversity: Interpersonal congruence in small work groups. ***Administrative Science Quarterly,*** 47: 296–324.

Priem, R. L., Lyon, D. E., & Dess, G. G. 1999. Inherent limitations of demographic proxies in top management team heterogeneity research. ***Journal of Management,*** 25: 935–953.

Robinson, J. P., & Shaver, P. R. 1973. ***Measures of social psychological attitudes.*** Ann Arbor, MI: Institute for Social Research.

Rotter, J. B. 1966. Generalized expectancies for internal versus external control of reinforcement. ***Psychological Monographs***: Complete number 609.

Runyon, K. E. 1973. Some interactions between personality variables and management styles. ***Journal of Applied Psychology,*** 57: 288–294.

Schwartz, S. H., & Bilsky, W. 1990. Toward a theory of the universal content and structure of values: Extensions and cross-cultural replications. ***Journal of Personality and Social Psychology,*** 58: 878–891.

Shaw, M. E. 1981. ***Group dynamics: The psychology of small group behavior*** (3rd ed.). New York: McGraw-Hill.

Shea, G. P., & Guzzo, R. A. 1987. Group effectiveness: What really matters? ***Sloan Management Review,*** 28(3): 25–31.

Snyder, M. 1974. Self-monitoring of expressive behavior. ***Journal of Personality and Social Psychology,*** 30: 526–537.

Spector, P. E. 1982. Behavior in organizations as a function of employee's locus of control. ***Psychological Bulletin,*** 91: 482–497.

Wagner, W. G., Pfeffer, J., & O'Reilly, C. A. 1984. Organizational demography and turnover in top management groups. ***Administrative Science Quarterly,*** 29: 74–92.

White, H. 1982. Maximum likelihood estimation of misspecified models. ***Econometrica,*** 50(3): 1–25.

Williams, K. Y., & O'Reilly, C. A. 1998. Demography and diversity in organizations: A review of 40 years of research. In B. Staw & R. Sutton (Eds.), ***Research in organizational behavior,*** vol. 20: 77–140. Greenwich, CT: JAI Press.

Zorn, C. J. W. 2001. Generalized estimating equation models for correlated data: A review with applications. ***American Journal of Political Science,*** 45: 470–490.

Zuckerman, M. 1979. ***Sensation seeking: Beyond the optimal level of arousal.*** Hillsdale, NJ: Erlbaum.

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